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Monographic issue

Natural disasters and complex  
humanitarian emergencies in the  
occupied Palestinian territories

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## *Letter from the editors*

The *Emergency and Disaster Reports* is a journal edited by the Unit for Research in Emergency and Disaster of the Department of Medicine of the University of Oviedo aimed to introduce research papers, monographic reviews and technical reports related to the fields of Medicine and Public Health in the contexts of emergency and disaster. Both situations are events that can deeply affect the health, the economy, the environment and the development of the affected populations.

The topics covered by the journal include a wide range of issues related to the different dimensions of the phenomena of emergency and disaster, ranging from the study of the risk factors, patterns of frequency and distribution, characteristics, impacts, prevention, preparedness, mitigation, response, humanitarian aid, standards of intervention, operative research, recovery, rehabilitation, resilience and policies, strategies and actions to address these phenomena from a risk reduction approach. In the last thirty years has been substantial progress in the above mentioned areas in part thanks to a better scientific knowledge of the subject. The aim of the journal is to contribute to this progress facilitating the dissemination of the results of research in this field.

This first number of 2016 of the *Emergency and Disaster Reports* covers the situation in the occupied Palestinian territories" (OPT or opt) that is the West Bank (including East Jerusalem) and the Gaza Strip which are occupied or otherwise under the control of Israel. Israel occupied the territories of the West Bank and Gaza Strip in the Six-Day War of 1967, which had been earlier occupied by Jordan and Egypt respectively, and has maintained control of them since.

According to many local and intentional humanitarian reports and studies addressing the severe on-going humanitarian situations in the occupied Palestinian territories, and the effects of these situations on the Palestinian population, these reports showed that opt is one of the hottest area for disasters in the world, particularly the Humanitarian Complex Emergencies which going on for more that sex decades without existing any possible humanitarian solutions to end the long-lasting conflict, which exacerbated the humanitarian situations and maximize the vulnerability of population .

Due to the Israeli Occupation and their colonizing policies since 1967, the humanitarian situation usually continues to get worse.

As a direct result, Palestinian people and government have been facing a multiple challenges in relation to governance, sustainable development and stability, among of these challenges Palestine is highly vulnerable to natural hazards, mainly earthquakes, floods, landslides, droughts, desertification as well as environmental degradation, their consequences however have been relatively small compared to the effects of the conflict in terms of mortality and morbidity, the conflict can have an effect on the response to a natural disaster reduction as well , also hinders the development of prevention and mitigation strategies .

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in the occupied Palestinian territories

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## 1. Introduction

According to many local and international humanitarian reports and studies addressing the severe on-going humanitarian situations in the occupied Palestinian territories (OPT), and the effects of these situations on the Palestinian population, these reports showed that OPT is one of the hottest areas for disasters in the world, particularly the Humanitarian Complex Emergencies which have been going on for more than six decades without existing any possible humanitarian solutions to end the long-lasting conflict, which exacerbated the humanitarian situations and maximize the vulnerability of the population.

Due to the Israeli Occupation and their colonizing policies since 1967 (the Israeli military occupation in West Bank and Gaza Strip), the humanitarian situation usually continues to get worse. As a direct result, Palestinian people and government have been facing a multiple challenges in relation to governance, sustainable development and stability, among of these challenges Palestine is highly vulnerable to natural hazards, mainly earthquakes, floods, landslides, droughts, desertification as well as environmental degradation [1], their consequences however have been relatively small compared to the effects of the conflict in terms of mortality and morbidity, the conflict can have an effect on the response to a natural disaster reduction as well, also hinders the development of prevention and mitigation strategies.

In the Occupied Palestinian Territory, national policies and legislations still focusing towards rescue and relief activities in different regions of the country in time of disasters, so there is a need to shift this to preparedness and prevention and incorporating Disaster Risk Reduction DRR in to development plans of the country, considering the disaster as national priority towards the implementation of "Hyogo Framework for Action" [2].

In his speech at the Global Platform of Disaster Risk Reduction in May 2013, the representative of the OPT raised the issue of the Hyogo Framework of Action HFA concentrating only on natural disasters risk reduction at all levels, while ongoing conflict is also an important cause of mortality, suffering and loss [3].

The Palestinian Authority are under the ongoing implementation of the HFA since 2009, and they developing strategic plan for this implementation, they made some progress towards the implementation, however, as a result of the unique Palestinian case, no geographic connection between the Gaza Strip and West Bank, nonexistence of national armed forces, weaknesses of national programs and public policies on preparedness, mitigation, and emergency response, the weak institutional capacity in disaster management and rescue operations, these factors effect negatively on the implementation of the HFA in the whole region [4].

Despite all difficulties, Palestinian National Authority developed National Development Plan 2010 and National Agency for Disaster Risk Mitigation, as well as allocated 2,26% national budget to DRR programs, and there is a presidential decree to create a contingency fund to cope with disasters, but it is not activated, as we are a dependent country on foreign financial assistance [5].

Eventually, there is an urgent need to build the resilience of Palestinian communities through knowledge, advocacy and training, and encourage the international organizations to improve the capacities of the Palestinian to cope with disasters at all levels.



Figure 1: Map of Palestine (source PCBS 2012)

## 2. Natural disasters in OPT and impacts

### General overview of natural disasters

Based on data obtained from different statistical reports and scientific research studies, Palestine is natural disasters prone-area particularly earthquakes and local site effects such as landslides, liquefaction and amplification, as a result of the geographical area of Palestinian land and the highly seismic activity of the Dead Sea, the earthquakes in the region are considered a major hazard, with low probability but high adverse impacts. Adding to this, the proposed Red Sea-Dead Sea Conveyance that will bring about two billion cubic meter of saline water from the Red Sea to the Dead Sea will be potentially, if constructed, a huge source of induced earthquakes.

Moreover, the future looks not so promising; due to the rapid population growth and the way the cities are developing in the opt, as more than 50% of the Palestinian population lives in what is defined as "hazard-prone" areas. These areas are particularly vulnerable, because of their dependence on complex infrastructures. Furthermore, the lack of knowledgeable professionals and technical capabilities in the opt, in regard to disaster-sound management, is another reason for the current chaotic situation [6].

Besides, the Palestinian People facing flash floods, droughts and desertification as well as extreme weather, these disasters have caused enormous losses and have set back economic progress, and leave the Palestinian at risk to loss their lives and properties. Most importantly, water scarcity, natural resources depletion and sever environmental degradation are other natural disasters which significantly considered a potential threat to opt.

Based on hazards mapping, the probalaibity of these natraul disasters is in incerasing for many reasons, one of these the geographical area of Palestine. For example, the vulnerability of flooding has increased in the last years due to the lack of land use planning and policy. In addition, the water flooding, landslides and desertifciation will reduce the land for agriculture, cussing of the undergoround water and reduce the amount of reliable drinking water as well.

On the other side, the sensetivity of Palestine case under the on-going confclit, rappid unrbinzation, the limitation of the resouceress and logistics, largely geopolitical situations, poor socio-economical, evrionmetanl situations, consdineing main challengess for the local authorities to intergrate DRR and management in the development plans and policy all at levels partcularly in the Gaza Strip, as well as these facotrs palyng an active role in exacerbad the humnitrain situations and woesen the capcity of Palestinian Authority to cope with these disasters [7]. This situations have highlighted the need for increased investment in disaster risk reduction systems and capacities in local communities and central government in opt.

In the following tables there is no clear estimated damage loss of the last natural disasters which happened in the last years reported in EM-DAT, except the damage loss estimated of the Waste Water Flood in the table 3. However, According to the

Palestinian Center for Human Rights report PCHR the damage loss on the agriculture livelihood in the last flood in 2013 were estimated 16, 5 million US\$ [8].

Table 1: Top natural disasters in Palestine (West Bank and Gaza Strip), 1900 to 2013, Sorted by numbers of killed

Disaster	Date	No of Killed
Flood *	8 - Jan -2013	5
Waste Water Flood **	27-Mar-2007	8

\* Source: EM-DAT: The OFDA/CRED International Disaster Database.

\*\*Source: MoH and OCHA Environmental Emergency, Waste Water treatment plant Flood 2007.

Table 2: Top natural disasters in Palestine (West Bank and Gaza Strip), 1900 to 2013, Sorted by numbers of affected people.

Disaster	Date	No of Affected
Flood *	8 - Jan -2013	12,500
Flood *	28-Feb-2012	1,500
Epidemics *	Mar-1983	943
Flood *	18-Jan-2010	500
Waste Water Flood **	27-Mar-2007	2,000

\* Source: EM-DAT: The OFDA/CRED International Disaster Database.

\*\* Source: Moh and OCHA Environmental Emergency, Waste Water treatment plant Flood 2007.

Table 3: Top natural disasters in Palestine (West Bank and Gaza Strip), 1900 to 2013, Sorted by damage loss estimated.

Disaster	Date	Damage (000 US\$)
Waste Water Flood *	27-Mar-2007	16,5 Million US\$

\* Source: Moh and OCHA Environmental Emergency, Waste Water treatment plant Flood 2007.

Table 4: Summarized table of natural disasters in Palestine, 1900 to 2013.

Disaster		No of Event	No of Killed	Total affected	Damage (000 US\$)
Epidemics *	Unspecified ave. per event	1	-	943	-
			-	943	
Flood *	Flash Flood ave. per event	1	-	-	-
			-	-	-
	General Flood ave. per event	3	5	14,5000	-
			2	4,833	-

\*Source: EM-DAT: The OFDA/CRED International Disaster Database.

According to the Disasters Profile of Palestine, there is no any data related to natural disasters documented and recorded in the PreventionWeb.net before 1983, the first



event was reported about Palestine it was in Mar /1983 related to epidemic event ,and the last updated was the documented event of flash flood in Jan/2013 [ 9 ].

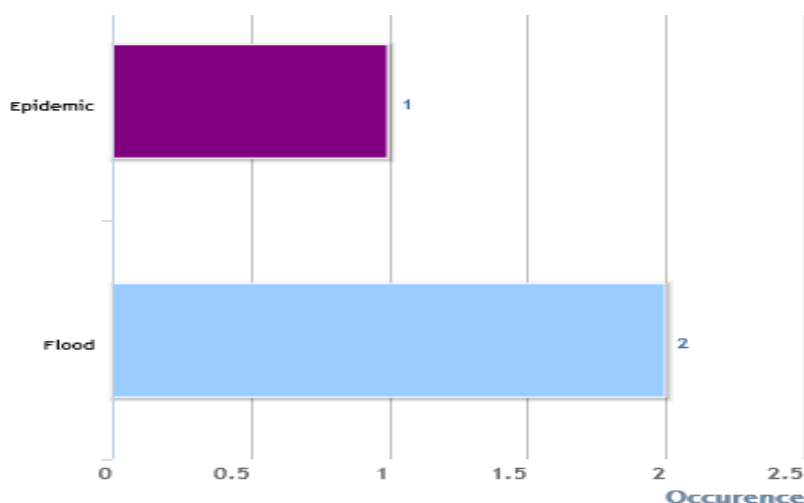
The following figures and tables showing the natural disasters that have occurred between 1980 and 2010 in opt, as it had reported by the Prevention Web .net. However, these needs to be updated with the last natural disasters which hit in opt in the last 3 years.

Table 5: Natural disasters from 1980 – 2010.

<b>Overview</b>	
No of events:	3
No of people killed:	0
Average killed per year:	...
No of people affected:	1,443
Average affected per year:	47
Economic Damage (US\$ X 1,000):	0
Economic Damage per year (US\$ X 1,000):	0

Source: "Prevention Web project of UNISDR"

Figure 2: Natural Disaster Occurrence Reported from 1980 – 2010



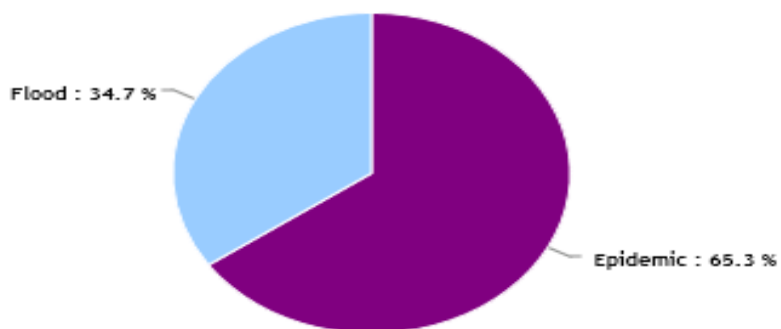
Source: "Prevention Web project of UNISDR"

Table 6: Average disaster per year from 1980 – 2010.

Drought :	...
Earthquake*:	...
Epidemic :	0.03
Extreme temp :	...
Flood :	0.06
Insect infestation :	...
Mass mov. dry:	...
Mass mov. wet:	...
Volcano:	...
Storm:	...
Wildfire:	...

\* Including tsunamis. Source: "Prevention Web project of UNISDR"

Figure 3: Percentage of reported people affected by disaster type.



Source: "Prevention Web project of UNISDR"

### Latest Common Natural Disasters in OPT

#### Flash Floods 10 Jan 2013

On January 2013, the intensive rains and snow storms that started on January 7<sup>th</sup> for three days and had struck large parts of the Opt have generated floods in several parts of the country, the rains were the largest in decades, according to meteorologists [10]. The Disasters Relief Emergency Fund DREF request targets both the replenishment of PRCs stocks for what has been distributed so far, and the immediate purchase and distribution of additional items (especially tarpaulins and shelter repair kits) for the continuation of the emergency [11].

According to the OCHA situation report, this winter storm characterized by torrential rains, strong winds, low temperatures and snowfall the occupied Palestinian territory Opt between 7<sup>th</sup> and 10<sup>th</sup> January ,the first 48 hours witnessed uninterrupted rains, with quantities reaching over 260 mm in some areas of the northern West Bank; overall, these three days received more than 40 % of the average seasonal rainfall , most streams and rivers reached their limits and some overflowed , combined with pre-existing precarious in the sewage and drain structure in many areas in the OPT, resulted in the unprecedented floods [12].

Palestinian casualties included three people who drowned and one who died of burns in northern West Bank; and in the Gaza Strip at least one person was killed and three were injured in tunnel collapses caused by the heavy rainfall. Field reports indicate that approximately 12,500 people in about 190 communities in the West Bank and the Gaza Strip were directly affected by the storm, negatively impacted by the loss of, or damage to, residences and agricultural livelihoods due to flooding and strong winds, some 200 homes were severely damaged and approximately 650 people were temporarily displaced, the weather conditions exacerbated pre-existing vulnerabilities stemming from movement, access and planning restrictions faced by Palestinian communities [13].

Additionally, over 20 people were injured across the opt in weather related incidents, the impact primarily relates to the loss of, or damage to, housing and agricultural infrastructure and assets, including greenhouses, animal sheds, livestock and field crops , due to flooding and strong winds. Moreover, the extreme weather also resulted in prolonged electricity cuts, interruption of access to services due to the flooding of roads, and the suspension of school classes. This extreme weather event has highlighted the need for increased investment in disaster risk reduction, preparedness and response capacities of the OPT [14].

In the northern West Bank, those most affected included residents of urban areas in the Tulkarm and Qalqiliya governorates, and the central and southern areas of the West Bank, as significant losses to property and displacement of some families have reported [15]. In the Gaza Strip, Rafah sustained the most damage to housing, primarily due to flooding and many homes were damaged by the high winds, large numbers of greenhouses were also reportedly destroyed, particularly in the northern West Bank and in the Gaza Strip [16].

Emergency response interventions were largely implemented by the Palestinian Civil Defense teams primarily search and rescue operations, and the Palestinian Red

Crescent Society PRCS, coordinated by the various Governorate offices, and proactively activated its four operation rooms in preparation for the arrival of the storm and heavy rains, It has so far provided first aid and NFI assistance to 130 families like tarpaulins, blankets, mattresses, hygiene kits, kitchen sets, and two tents to 778 persons [17].

As the scope and impact of the storm became more evident, UN agencies and international NGOs began intervening in support of ongoing efforts, covering emerging needs and gaps in areas where they were already operational. Interventions by international organizations included distribution of non-food items, as well as food assistance [18].

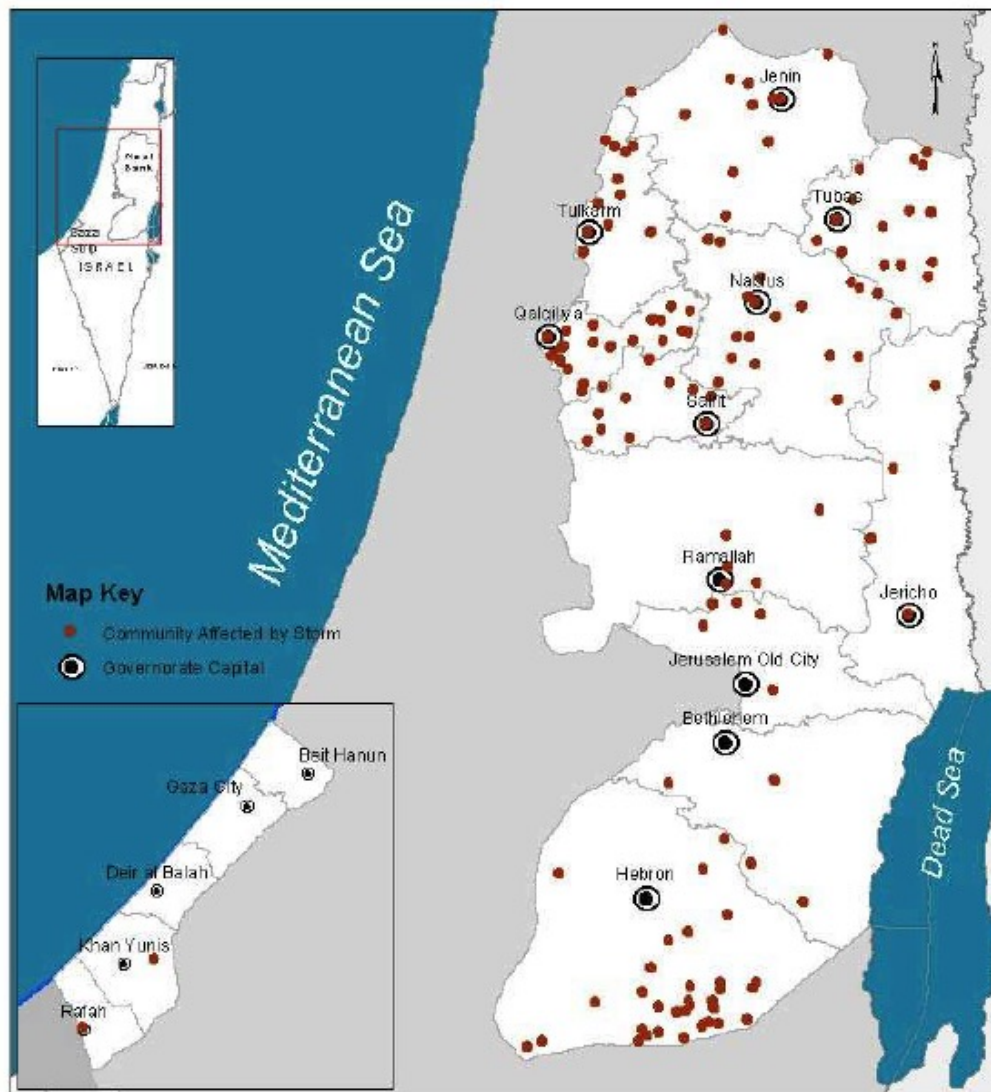


Figure 4: Map of most affected areas of opt, due to 2013 Flash Floods, OCHA.

## The effect on the Palestinian Humanitarian needs

### Shelter and Non-Food Items NFI

Official situations reports indicate that over 1,570 homes across the opt sustained damage due to flooding and strong winds, two-thirds of them in the West Bank and one third in the Gaza Strip, the vast majority of these were leading to the displacement of some 650 people, and they were in high need of NFI assistance.

In terms of disasters response to this flash flood, in Gaza Strip a collective effort by PRCS, the Ministry of Social Affair MoSA, UNRWA, and Catholic Relief Services CRS, enabled a large number of affected families to be assisted. International responses by UNRWA. The Coastal Municipalities Water Utility CMWU in Gaza had worked around the clock to drain water from flooded areas and houses, with technical support provided by Save the Children UK [19].

In the West Bank, PRCS, the Ministry of Social Affair MoSA, UNRWA, UNICEF, World Vision and ACF distributed NFIs to affected households, including thousands of mattresses, blankets, tarpaulin, kitchen sets and heaters. However, due to access problems and the large numbers of families affected, the rate of coverage has been more limited than in the Gaza Strip.

### **Food Assistance**

Food assistance needs are primarily among herder communities and poor urban families, whose own food stocks were damaged or destroyed by the weather, and who also lost housing and productive assets. To ensure food security, UNRWA and the World Food Programme WFP have maintained their normal distributions to a caseload of nearly 1.1 million people in Gaza. Additionally, the MoSA distributed more than 2,700 food packages among the most vulnerable families affected by the storm [20].

### **Agriculture**

The agriculture sector has been severely impacted by the extreme weather conditions, hundreds of families depending on herding and farming for their livelihoods experienced heavy losses in greenhouses, field crops, livestock, and animal sheds particularly in the northern West Bank, while the precise scope of damage were expected to be extensive, official reports indicate that the loss of animal sheds resulted in increased mortality rates of livestock. This has raised particular concern regarding the resilience of already vulnerable herding communities and requires an immediate response. The poultry sub-sector was also severely hit, with more than 100,000 chickens dead in the northern West Bank alone.

The Ministry of Agriculture MoA had conducted an assessment at the directorate level to document the damage and inform a response plan. In parallel, it has launched an appeal to the international community to support the rehabilitation of damaged structures and prevent further losses [21].

### **Flash Flood 2012**

Large parts of the occupied Palestinian territories were hit by exceptionally heavy storms, that resulted in the evacuation of more than 300 families from their houses due to floods, and major damage in the houses located in the districts of Gaza, Hebron, Jenin, Salfit, Ramallah and the Jerusalem area beyond the separation wall [22].

In the case of the houses close to the separation wall, some houses were flooded due to their proximity to the wall which impeded the rain to flow away. In the case of Jerusalem and Hebron, some of the affected persons are Bedouin refugees who live under the threat of a forced displacement, the heavy rain and low temperatures affected the already difficult living conditions of the persons in these mentioned areas.



Figure 5: Map of affected areas of opt, due to 2012 Flash Floods, OCHA.

### **Effect of this flood on the Palestinian Humanitarian needs**

On Friday 2<sup>nd</sup> of March, the situation has worsened, the heavy and continuous rains had a particularly heavy impact on the many districts of Gaza and West Bank, including Hebron, Ramallah and Jerusalem, the heavy rain took the shape of snowstorms, due to the large quantities of rainfall, which surpassed 125% of the average rainfall during previous years, the level of rain absorption by the land is reduced [23].

In terms of response to this flood , the local authorities in collaboration and coordination with Civil Defense , they had established operation rooms in different cities to monitor the heavy winter storms which hit the opt According to situation report of PRCS , they immediately deployed rapid needs assessment teams to assess the needs of the most affected communities, based on the assessments and in coordination with the local Governorates' Emergency Committee, the PRCS volunteers started emergency relief items distribution in the form of mattresses, blankets, hygiene kits, kitchen kits, plastic sheeting and tarpaulins to approximately 1,123 persons [24].

### **Flash Floods 2009**

On 2009, torrential rains hit the Gaza Strip, causing heavy floods in huge parts of this densely populated and poor area. After summer-long drought, the ground was not able to absorb the huge mass of water which washed away sand, dust, and garbage from streets; merged with sewage from underground reservoirs; and filled the ground floors of the homes with mud, garbage, and contaminated dirty water [25].

Among the worst hit areas where the poorest people in the Gaza Strip were located. In the northern part of Gaza Strip, dozens of houses were under water and mud, in the southern city of Khan Younis, where there was no functioning or very poor drainage and sewage systems, the dirty and contaminated water found its way through streets into homes and other buildings [26].

One of the sewage treatment plants in the north of the Gaza Strip was filled up to the brink of its banks, creating fears that this sewage water may completely bury residential areas, like what happened the previous year with another dam bursting its banks, submerging a number of houses, and even drowning some people, floods of this magnitude is a rare experience in the Gaza.

The local Authority with cooperation with PRCS and ICRC responding to this flash floods from the beginning of the this torrential rains through providing logistical support to the civil societies and other relief items , as well as there was closed coordination initiatives among the local municipalities, the governmental bodies, other NGOs [27].

Several response teams of the national and international organizations were deployed to the most affected areas, registering the number of families and individuals whose

homes were flooded and destroyed, most affected people were given top priority in term of receiving relief, logistical support, and medical care. Throughout the relief operation PRRC deployed some 150 volunteers in the field, evacuating people from the affected areas, cleaning the flooded areas and erecting shelter to some of those families [28], community volunteers had responded as well by working to maintain opening sewage and drainage systems functioning .

## **Earthquakes**

Palestine is a prone-area earthquake, during the last centuries there were allot of earthquakes hit the Palestine and neighboring countries ,most likely Israel and Jordan , most of these earthquakes were epicentered in the Dead Sea , one of the strongest earthquakes hit Palestine was in July 1927 [29], a destructive earthquake (6.25 magnitude and epicenters some 15 km north of the Dead sea), with 250-500 casualties; flow of Jordan river stopped for 1/2 hours by landslides, and the other one is 1943 ,a strong earthquake hit Palestine , according to the experts at this time these the 1943 and 1927 earthquakes were the strongest in region during 20th century [30].

In addition, in last October of 2013 a minor earthquake shakes north Palestine twice within 27 hours, according to the Geophysical Institute of Israel the earthquake registered a light 3.6 on the Richter scale, no injuries or significant damage was reported. The other one was a mild earthquake measuring 3.5 on the Richter scale hit northern Israel and people in West Bank felt it [31].

Based on the location and the seismicity of the region, an earthquake of magnitude more than 6 is expected to happen, taking into consideration 1927 earthquake, a major destructive earthquake is expected at any time in the near future and will be epicentered in the north of the Dead Sea, causing severe damage and loss due largely to the high vulnerability of common buildings. On the other hand the predicted earthquake could be epicentered in the southern part of the Dead Sea according to other studies in the region [32].

Many assessment and site investigations in many areas in the West Bank showed that several urban areas have high vulnerability to earthquakes, the probability of these occurrences will be increased if these areas are hit by strong earthquakes. Lack of land use, planning code, random urban expansion and management practices have increased the vulnerability of seismic site effects like; landslides, liquefaction and amplification [33], these site effects playing an important role on the intensity of earthquakes in particularly West Bank.

The problems relating to earthquakes in the Palestinian Territories can be summarized, but not limited, to the following:

1- High vulnerability to earthquake damages and losses, as a direct result of high percentage of bad construction practices and weak buildings that do not comply with



seismic resistance requirements, as well as common fatal design mistakes, absence of national legislative ,laws and regulations, as well as effective mechanisms.

2- Lack of national programs and public policies on preparedness, mitigation, and emergency response.

3- Weak institutional capacity in disaster management and rescue operations.

4- Lack of awareness by citizens, and weak capacity of professionals, engineers, and decision makers.

### **Dead Sea Earthquake**

The 11 February 2004 earthquake (ML 5.2) with an epicenter in the northeastern part of the Dead Sea basin [34] (at latitude 31.679 N, longitudes 35.585 E with a focal depth of 17 km) caused slight damage to several regions in opt, This earthquake was felt in most cities: Jericho, Hebron, Nablus, Ramallah, Bethlehem and Jerusalem as well as Gaza, but no life loss was reported [35].

Moreover, few smaller earthquakes followed this Earthquake at different locations and times of the same year; 7 July ML 4.8 (Lat 31.97 Long 35.55), 20 July ML 3.6 (32.46, 35.25), 2 December ML 2.8 (32.25, 35.37) [36]. They mainly felt in the northern part of West Bank especially in Nablus City, although they are not closed to Nablus but because of some site effects factors (geological formations, structures etc.) Based on post-earthquake investigations, many reinforced concrete buildings in Palestine suffered slight nonstructural damages (damage grade 1 according to European Macro seismic scale 1998 “EMS- 1998”) [37], such as hair-line cracks in very few walls, specially over frame members or in walls at the base and fine cracks in partition walls. Three old schools suffered moderate structural damages and substantial non-structural damages (damage grade 3).

The Earthquake affected also many old masonry buildings in the Palestinian old cities (Jerusalem, Nablus, Hebron, Bethlehem, etc.), in Nablus city few historical buildings have been affected with damages between grades 2 to grade 4. The damages that had been occurred had usually been at zone of pre-existing weakness. In the light of the post-earthquake investigations the effected masonry buildings suffered with many kinds of damages, such as: crack patterns in pillars, slippage between the block, corner detachment, detachment between few perpendicular walls (in a corner) [38].

Studies of historical earthquakes for the past few hundred years (Figure 6) demonstrate that the damaging earthquakes were located along the Dead Sea Transform fault 1-9, 26. The largest destructive recorded earthquake (Nablus Earthquake) occurred on 11 July 1927 north Jericho at the boundary between the Arabian and the Sinai plates and had a magnitude of about 6. [39] (Figure 7).

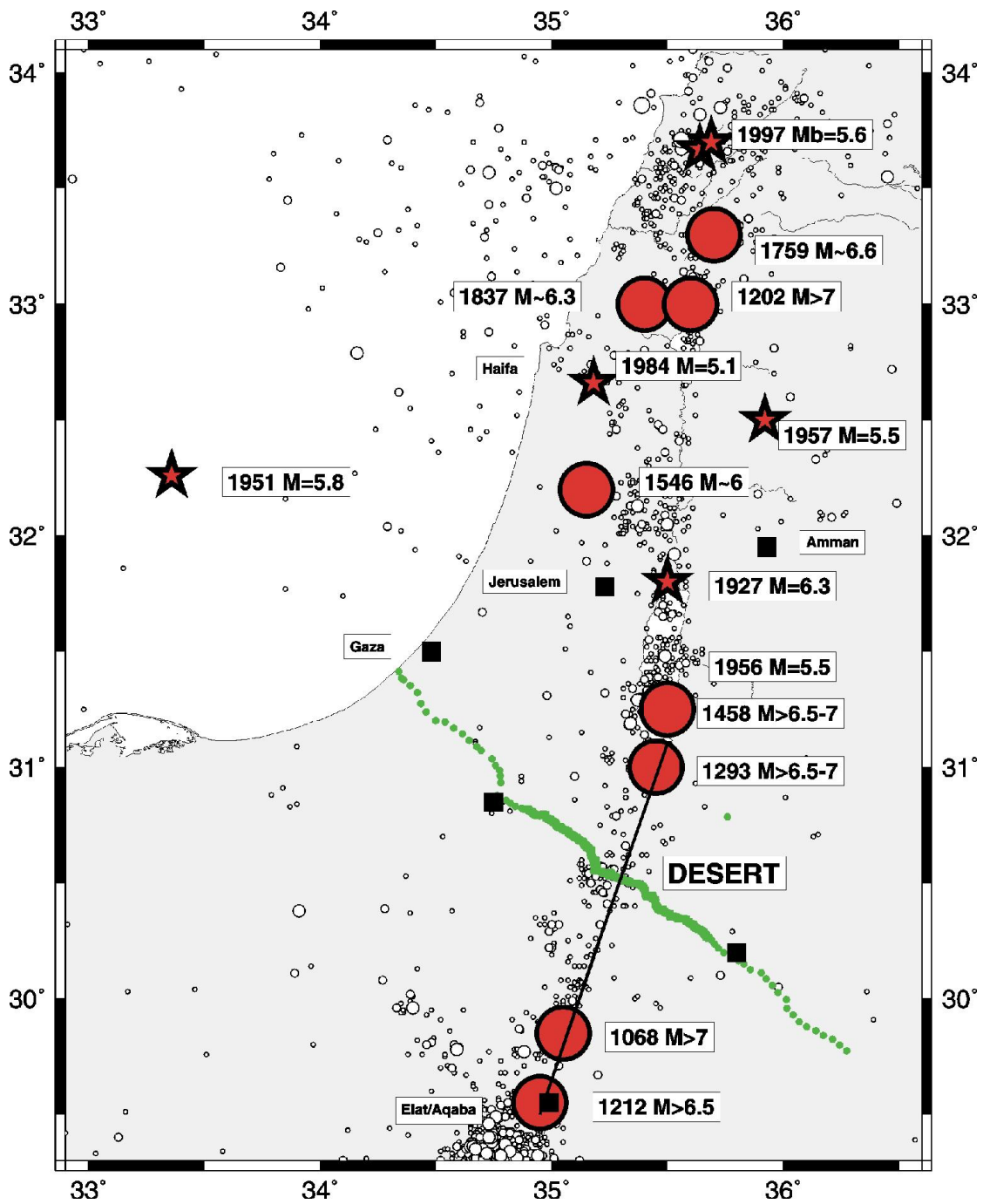


Figure 6: Seismicity map of the Dead Sea transform region 9, 15, 26 for the period 1000-2004. Also shown is the earthquake of 11 February 2004.

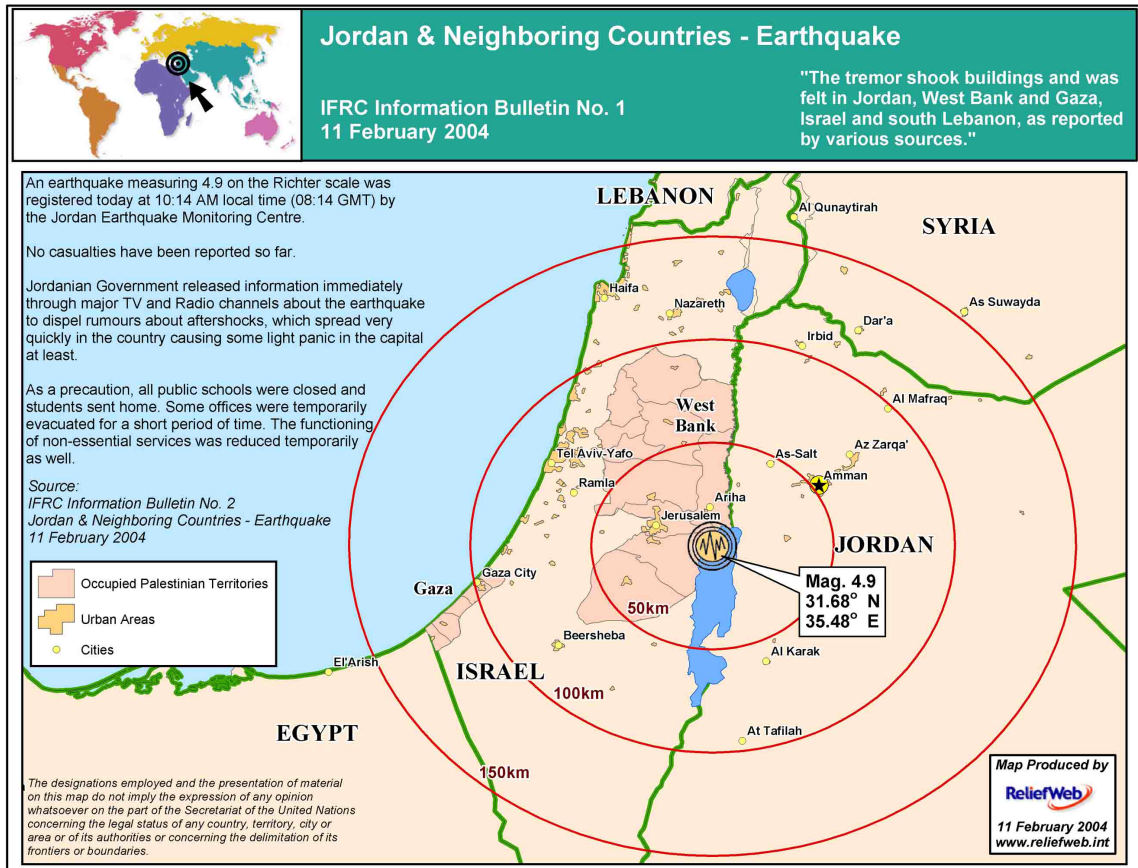


Figure 7: Dead Sea Earthquake, 11 February 2004 ReliefWeb.

## Environmental disasters in OPT

### Wade Gaza Flooding

Wadi Gaza is one of the main natural features of the Gaza Strip, It is about 105 kilometers length, and it extends from the armistice line east of Gaza to the Mediterranean coast, the highest point of the valley reaches 30 meters above sea level, and the length of its path across the Gaza Strip spans 7 kilometers.

According to the local environmental experts in Gaza Strip, the Wadi Gaza is high risk environmental area, Just a couple of decades ago it was one of the nicest agricultural and residential areas in Gaza and right now it is disappeared, and all aspects of life vanished, even the wild ducks, water storks and gulls have stopped coming here because the valley turned into a garbage dump and an estuary for the sewage [40].

During winter seasons the heavy rains worsen the situations there, and the risk of flooding leave people who living their more vulnerable to water-prone diseases and vector –prone diseases, this also leads to the displacement of residents, kills their livestock and destroys their crops. On 12<sup>th</sup> December 2011 the heavy rains has caused a massive flood in some densely populated areas of the Gaza Strip, the flood is fatal and has also caused about 1,000 families to be displaced, the situation became worse when areas bordering the Gaza Valley were also flooded, the Flood could be seen covering an area of approximately one square kilometer, all the way to the Sea of Gaza. Unfortunately, the soil was unable to absorb the huge mass of water and this resulted in dirty water, sand, dust and garbage contaminating the ground floors of homes [41].

According to the situation report of PRCS, PRCS's teams in closed coordination with the local authorities have evacuated many trapped families in the areas around , as well as they distributed NFI for affected people [42 ]. The Environmental Quality Authority in Gaza explained that due to the water flow stopping across the valley as a result of the Israeli dams, along with the fact that the central municipalities rely on the course of the valley to get rid of sewage around the area, a serious environmental disaster has emerged in the valley. Furthermore, the Palestinian families there are live in constant fear that Israel will open the dams which set up on its borders with the Gaza Strip, and would cause a major humanitarian disaster. On 18<sup>th</sup> of January 2010, the Israeli authorities opened the dam of Wadi Gaza without prior warning, this led to the inundation of dozens of houses and the displacement of about 100 families and destroyed their livelihood. At the time, according to Gaza's Civil Defense seven people who were living there survived form drowning [43].

### **The sever deterioration of the water and sanitation services**

The limited availability of building resources, spare parts, and fuel has prevented the adequate operation and maintenance of the water and sanitation infrastructure particularly in Gaza, creating a significant public health and environmental hazard .The decline of the system is reflected at multiple levels, including the current inability of Gaza's wastewater utility to properly treat the volume of sewage produced. Consequently, every day approximately 80 million liters of untreated and partially treated wastewater are being discharged into the environment. In the Middle Area of Gaza, for example, about 10 million liters of raw, undiluted, sewage flows every day into the Gaza Wadi and into the Mediterranean Sea [44].

The Gaza wastewater treatment plant, which currently treats 50 million liters of sewage a day was originally designed to treat only 32 million liters per day. As a result, the wastewater discharged into the sea contains twice the safe standard amount of biological pollution and suspended solids. An existing project aimed at upgrading the plant's capacity to 70 million liters a day is still in an early planning stage as a result of being delayed for an extended period of time due to the blockade and the ongoing conflict.

The emerging public health concerns due to the inability of the current system to properly treat the current volume of sewage produced in Gaza are significant.

Microbiologically contaminated seawater found along the Gaza Strip coast poses a serious health hazard not only to people using beaches for recreation, but also to the entire population, through potentially contaminated sea food [45].

In Gaza only 5-10 % of the extracted water is considered drinkable when compared to WHO safety standards. In Khan Younis governorate, one of the worst affected areas, the average levels of nitrates detected during 2008 in the water wells was 169 mg/L (the safe WHO level 50 mg/L). Consumption of water with high concentration of nitrates compromises the transmission of oxygen in the blood and could cause an increase of the potentially lethal “blue-baby syndrome” among infants in the Gaza Strip. The deterioration of the sanitation services is likely to have also contributed to increase in the prevalence of watery diarrheal disease WDD among children aged 9-12 months as reported by UNRWA in March 2009. For example in comparison to 2008 figures there was a major increase of WDD in Khan Younis by 88 percent and in north Gaza by 77 percent [46].

### 3. Technological disasters in OPT

#### Brief Summary of top technological disasters

According to the top technological Disasters Country Profile of Palestine, there is no any data related to technological disasters recorded in the CRED EM-DAT particularly pre 1983, the first event was reported in Oct /1999 related to Industrial Accidents and updated with miscellaneous accidents in 2007. On the other hand, there is no any data reported related to economic damage estimated form the technological disasters [47].

Table 7: Top Technological Disasters in Palestine (West Bank and Gaza Strip), 1900 to 2013, sorted by numbers of killed.

Disaster	Date	No of Killed
Miscellaneous accident *	27-Mar-2007	765
Industrial Accident *	21-Oct-1999	20

\* Source: “EM-DAT: The OFDA/CRED International Disaster Database

Table 8: Top Technological Disasters in Palestine (West Bank and Gaza Strip) 1900 to 2013, sorted by numbers of total affected people.

Disaster	Date	No of Affected
Industrial Accidents *	21-Oct-1999	14
Miscellaneous accident *	27-Mar-2007	5

\* Source: “EM-DAT: The OFDA/CRED International Disaster Database

Table 9: Summarized table of Technological Disasters in Palestine (West Bank and Gaza) from 1900 to 2013

Disaster		No of Event	No of Killed	Total affected	Damage (000 US\$)
Industrial accident *	Fire ave. per event	1	14	20	-
			14	20	
Miscellaneous accident *	Collapse ave. per event	1	5	765	-
			5	765	-

\*Source: "EM-DAT: The OFDA/CRED International Disaster Database.

#### 4. Humanitarian complex emergencies in the OPT and impacts

Palestine is one of the hottest zones over the world; it is one of the world's most protracted conflicts. It's long –lasting conflict without any humanitarian solutions exist in the ground, The territory of the Palestinian National Authority includes two separated geographical areas, the West Bank and the Gaza Strip with a total population around 4 million, and they are living under the occupation since 1948 till now. Since the occupation, Palestine passed through different humanitarian complex emergencies, as a result of the unjust occupation and there ongoing colonization polices, as well as the continuous efforts of the occupier to fragment the geographical areas of opt , and violate the Palestinian rights , these sever humanitarian situations are worsening the whole aspect of Palestinian lives .

The ongoing conflict perceived to be the most significant anthropogenic disasters over the time affecting the Palestinian people in the opt, and can increase the population's exposure to additional hazards and erode coping mechanism at all levels of preparedness and response, while at the same time, the occurrence of disasters during or in the immediate aftermath of conflict can exacerbate humanitarian consequence and maximize the vulnerability of population.

Therefore, due to the political, economic and social conditions dominating the opt the Palestinian people and government in the opt face a multitude of challenges in relation to governance, development, sustainability, and disasters risk reduction, as a result of these conditions Palestine classified as a fragile state and the vulnerability index scores medium at in 2012 on the website of Humanitarian Global Assistance GHA [48].

##### **Brief Summary of top man-made disasters or/and complex emergency in Palestine**

The Number of martyrs killed in the Al Aqsa Intifada between September 20<sup>th</sup>, 200 and December 31<sup>st</sup>, 2012 was 7,766, up from 7,235 at the end of 2009. Of these 2,183

were from the West Bank (2,059 males and 124 females) and 5,015 were from Gaza Strip (4,601 males and 414 females). The remaining martyrs were from the 1948 territories and outside Palestine. The bloodiest year was 2009 with 1,219 Palestinian martyrs, followed by 2002 with 1,192 martyrs. In addition, 306 martyrs were killed during 2012, 15 from the West Bank and 291 from Gaza Strip, of whom 189 were killed during Israeli Attacks on Gaza Strip in November 2012 [49].

Table 10: Top man-made disasters or/and complex emergency in Palestine (West Bank and Gaza Strip), 1900 to 2013, sorted by numbers of killed .

Disaster/ Complex Emergency	Date	No of Killed
Al Aqsa Second Intifada *	Sep 29 <sup>th</sup> 2000 – Dec ,31 <sup>st</sup> ,2012	7,766
2008-2009 Conflict **	Dec 27 <sup>th</sup> 2008 – Jan ,17 <sup>th</sup> ,2009	1,419
2012 Conflict ***	Nov, 14 <sup>th</sup> 2012 - Nov, 21 <sup>st</sup> 2012	182

\* Source: Palestinian Central Bureau of Statistics (PCBS) May , 2013.

\*\*source : Palestinian Center for Human Rights (PCHR) .

\*\* Source: Ministry of Health Moh Gaza Strip.

Table 11: Top man-made disasters or/and complex emergency in Palestine (West Bank and Gaza Strip), 1900 to 2013, sorted by numbers of affected people.

Disaster/ Complex Emergency	Date	No of affected people
Al Aqsa Second Intifada *	Sep 29 <sup>th</sup> 2000 – Dec ,31 <sup>st</sup> ,2011	60,043
2008-2009 Conflict **	Dec 27 <sup>th</sup> 2008 – Jan ,17 <sup>th</sup> ,2009	5,000
2012 Conflict ***	Nov, 14 <sup>th</sup> 2012 - Nov, 1 <sup>st</sup> 2012	1,399

\* Source: Palestinian Central Bureau of Statistics (PCBS) May , 2013.

\*\*source : Palestinian Center for Human Rights (PCHR) .

\*\*\* Source: Ministry of Health Moh Gaza Strip.

Table 12: Top man-made disasters or/and complex emergency in Palestine (West Bank and Gaza Strip ), 1900 to 2013, sorted by economic damage costs

Disaster/ Complex Emergency	Date	Damage (000 US\$)
Al Aqsa Second Intifada *	Sep 29 <sup>th</sup> 2000 – Dec ,31 <sup>st</sup> ,2011	NA
2008-2009 Conflict **	Dec 27 <sup>th</sup> 2008 – Jan ,17 <sup>th</sup> ,2009	1.9 Billion US \$
2012 Conflict ***	Nov, 14 <sup>th</sup> 2012 - Nov, 1 <sup>st</sup> 2012	1.2 Billion US\$

\*\* Source: Palestinian Central Bureau of Statistics (PCBS)

\*\*\* Source: Gaza Government.

## **Some of humanitarian complex emergencies in OPT**

### **2008-2009 Conflict “Operation Cast Lead”**

On December 27, 2008, Israel launched Operation Cast Lead CLO, a massive 22-day military assault on the Gaza Strip, the ferocity of the attack was unprecedented in the more than six-decade-old conflict between Israelis and Palestinians. Throughout the operation Israeli forces frequently obstructed access to medical care and humanitarian aid for those wounded and trapped, they prevented ambulances and medical staff from attending to the wounded and transporting them to hospital and in several cases targeted ambulance and rescue crews and others who were trying to evacuate the wounded.

Randomly placed telephone calls with recorded warning messages, radio broadcasts and leaflets dropped by the Israeli army all over Gaza telling people to leave their homes and neighborhoods caused widespread panic but offered little protection. In some areas residents were trapped in their homes, hearing the Israeli army broadcasts warning people to leave but unable to do so because Israeli forces in the area were not allowing any movement and therefore anyone who went out risked coming under fire, for others who fled their homes were killed or injured when UN schools and other places where they had sought shelter came under Israeli attack [50].

For several weeks prior to start of the Operation, the Israeli army refused to allow independent observers, journalists, international human rights monitors and humanitarian workers to get into Gaza, effectively cutting off Gaza from the outside world, after Israeli forces left on 18 January, the area looked as if it had been wrecked by an Earthquake.

Israel and Egypt kept Gaza’s borders sealed throughout operation and its more 1.7 million inhabitants could neither leave nor find a place in Gaza where their safety could be guaranteed. In the aftermath of the offensive, an UN-appointed fact finding mission found strong evidence of war crimes and crimes against humanity.

Cast Lead proceeded in two phases: a week of intense aerial bombing followed by two weeks of a joint air and land assault and invasion, the surprise attack began at 11:30 AM on December 27, 2008, with Israeli F-16 fighter jets, Apache helicopters, and unmanned drones striking more than 100 locations across the tiny, crowded Gaza Strip within a matter of minutes, among the targets were four Palestinian police stations, including the central police headquarters in Gaza City, where a graduation ceremony for new officers was underway. 99 police personnel and 9 members of the public were killed in the first minutes of the attack. By the end of the first day at least 230 Palestinians had been killed, the massive bombardment continued until January 3, 2009, when the Israeli army invaded the Strip from the north and east of Gaza. On January 18, 2009, under enormous international pressure Israel declared a unilateral ceasefire and withdrew its forces from Gaza, Palestinian armed groups followed with a separate unilateral ceasefire as well [51].



## **Casualties**

Reports of the exact number of Palestinians killed vary, but casualty figures supplied by credible independent nongovernmental organizations are generally consistent. The Gaza-based Palestinian Centre for Human Rights reported that the offensive left 1,419 Palestinians dead, including 1,167 civilians, the Centre also reported more than 5,000 Palestinians wounded [52]

According to investigations by independent Israeli and Palestinian human rights organizations, between 1,385 and 1,419 Palestinians were killed during Cast Lead, a majority of them civilians, including at least 308 minors under the age of 18, more than 5000 were wounded 40-70% of the them suffered severe traumatic injuries. According to the UN 3,540 housing units were completely destroyed, with another 2,870 sustaining severe damage, more than 20,000 people many of them already refugees were homeless. Attacks on Gaza's electricity infrastructure caused an estimated \$10 million in damage, according to the Israeli advocacy group Geisha [53].

Besides, 268 private businesses were destroyed, and another 432 damaged, at an estimated cost of more than \$139 million, according to an assessment by the Private Sector Coordination Council, a Palestinian economic group. A separate report found that between 600 and 700 factories, workshops and businesses were destroyed or damaged, according to the Palestinian Union of Businesses and the Palestinian Federation of Industries [54].

According to the UN Relief Works Agency UNRWA, which provides services to Palestinian refugees, the offensive damaged almost 20,000 meters (approx. 12 miles) of water pipes, four water reservoirs, 11 wells, and sewage networks and pumping stations. Israeli shelling, also damaged 107 UNRWA installation, eighteen schools, including 8 kindergartens, were destroyed, and at least 262 others damaged, Numerous Palestinian government buildings, including police stations, the headquarters of the Palestinian Legislative Council PLC, and part of Palestinian President Mahmoud Abbas' compound, were also destroyed [55]

After an investigation of the destruction of civilian infrastructure in Gaza, Human Rights Watch accused the Israeli military of violating the international ban on "wanton destruction" found in the Fourth Geneva Convention [56]. On the other side, according to Israeli authorities, 3 Israeli civilians and one soldier were killed by rockets fired from Gaza during CLO , 9 Israeli soldiers also died in combat in Gaza, including 4 killed by friendly fire, and 518 Israelis were wounded According to the UN [57].

The impact of the military operation on the health sector was severe, 16 health workers were killed and 25 injured, 29 ambulances were damaged or destroyed, medical facilities ran short of critical medical supplies, maternal and child health services at PHC level were disrupted and health services for some 40% of chronically ill patients had to be interrupted during the attack. In addition, medical facilities

sustained direct damages, 40 PHCs out of 60 and 12 hospitals out of 24 were damaged to varying degrees, some of them by direct hits, and damages to PHCs were estimated between USD 191,030 and USD 341,930.2, the following table showing the damages to hospitals during the attack [58].

Table 13: Damages to hospitals (Source: UNDP and Moh Gaza)

#	Hospital	Damage (USD)	% Hospital Damages
1	AL-Awad Hospital	10,000	0.2
2	Al-Wafa Hospital	500,000	11,7
3	Al-Dora Hospital *	25,000	0.6
4	Al-Quds Hospital -PRCS	3,163,500	74,2
5	El-Shefa Medical Complex *	140,000	3,3
6	Nasser Medical Complex *	50,000	1,2
7	Al Nasser Child Hospital	1,500	0,0
8	Aqsa Martyrs Hopspital *	85,000	2.0
9	European Gaza Hospital *	228,000	5,3
10	Beit Hanoun Hospital	20,000	0,5
11	Fata Hospital	5,000	0,1
12	Eye Hospital *	34,000	0.8
<b>Total</b>		<b>4,262,000</b>	<b>100.0</b>
* MOH Estimates Only			

Table 14: Estimated cost of water and sanitation damage by the CLO (OCHA ).

Category	Damages in (USD )
Water Wells	1,007,000
Water Reserviors	
Water House Conections and Water Networks,Waste Water Networks plus Contingency	4,647,740
Water and Waste Water Facilities	134,000
Norht Gaza Emeryancy Sewege Treamnt Plant (NGEST)	183,950
<b>Total</b>	<b>5,972,690</b>

### Evidence of war crimes

In April 2009, following international outrage at the carnage caused by CLO, the UN Human Rights Council established a Fact Finding Mission to investigate possible violations of international law committed during the conflict, leading the mission was Justice Richard Goldstone, a former judge of the Constitutional Court of South Africa and war crimes prosecutor for Rwanda and former Yugoslavia.

The four members of the mission visited Gaza in late May and early June 2009, holding hearings there and in Geneva, they conducted 188 interviews and reviewed more than

10,000 pages of documents, more than 30 videos, and 1,200 photographs. Israel refused to cooperate with the inquiry, denying the mission the opportunity to meet with Israeli officials or visit the West Bank [59].

As a result of its investigation, the mission issued the so-called "Goldstone Report," a 575-page document detailing alleged war crimes and crimes against humanity committed by the Israeli military. The report also accused Palestinian armed groups of war crimes as a result of indiscriminate rockets attacks on Israeli civilians living near Gaza. This report documented 36 specific cases and incidents where Israeli forces allegedly violated international laws during the Gaza offensive, these include [60]:

**Samouni family massacre:** In perhaps the most infamous incident of the war, Israeli soldiers ordered around 100 members of the Samouni family into a single building in the Zaytoun area of Gaza City, soldiers held the family in the building for 24 hours before shelling the building on January 4, 2009, 21 members of the family, all of them civilians were killed.

**Al-Daya family massacre:** On January 6, an Israeli F-16 jet fired a missile at the home of the Al-Daya family, also in the Zaytoun neighborhood of Gaza City, killing 22 family members, most of them women and children.

**White flag killings:** The UN mission and human rights groups also documented several cases in which witnesses saw Israeli soldiers kill Palestinians who were fleeing while carrying makeshift white flags to indicate their status as civilians [61].

**Use of white phosphorus in populated areas:** Rights groups, journalists, and the UN mission in Gaza also documented numerous instances of the use of white phosphorus, an incendiary substance that is illegal when used in populated areas. Israeli forces used white phosphorus in attacks on at least two hospitals (Al-Quds Hospital and Al-Wafa Hospital), as well as the central UN compound in Gaza City, numerous civilian casualties were caused by white phosphorus in the small, densely populated Strip [62].

### **2012 Conflict "Operation Defensive Pillar"**

On 14 November the Israeli Air Force IAF launched an airstrike that targeted and killed a member of Palestinian resistance groups, marking the start of the Israeli military offensive "Operation Defensive Pillar" which lasted for eight days, this event followed several weeks of intermittent escalations in violence in Gaza and southern Israel, the escalation was detrimental to an already fragile humanitarian situation in Gaza where some 80 per cent of households are in need of assistance.

This latest escalation was characterized by IAF airstrikes and firing from Israeli naval vessels and tanks into Gaza and Palestinian rocket fire into Israel, the targeting by the Israeli military of residential properties in Gaza resulted in a high number of civilian casualties, approximately 450 housing units were destroyed or sustained major damage, while another 8,000 houses sustained minor damage, at the height of the escalation some 15,000 estimated to be displaced. Approximately 12,000 individuals in

Gaza City and Northern Gaza governorate fled their homes and they sought to emergency shelters set up in 14 UNRWA and two government schools [63]. Following sustained diplomatic efforts, an Egyptian-brokered ceasefire between Israel and Palestinian resistance groups entered into force on 21 November.

### Casualties

The Palestinian MoH reported 182 fatalities (158 males and 24 females) during the eight days of hostilities: 47 (26%) children, including 16 under 5 years old, 12 women and 20 adults above 60 years old. Most of the fatalities (87.9%) had multiple injuries. The MoH also reported 1399 injuries, 28% female and 37% (516) children, one third of whom were under 5 years old , 28.3% of injuries were at the head and neck, 19% in more than one location of the body, 17%, 13% in the upper limbs and 13% were superficial wounds [64].

### Humanitarian Impact of the conflict

#### Displacement

The operation led to an estimated internal displacement of 14,920 people from all Gaza governorates (See the figures 8, 9) [65].

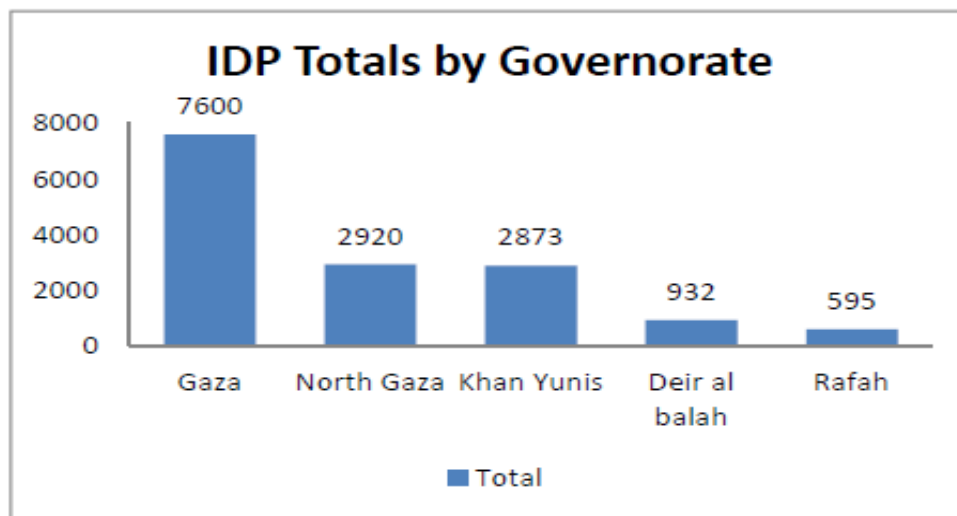


Figure 8: IDPs by Governorate (Source: OCHA)

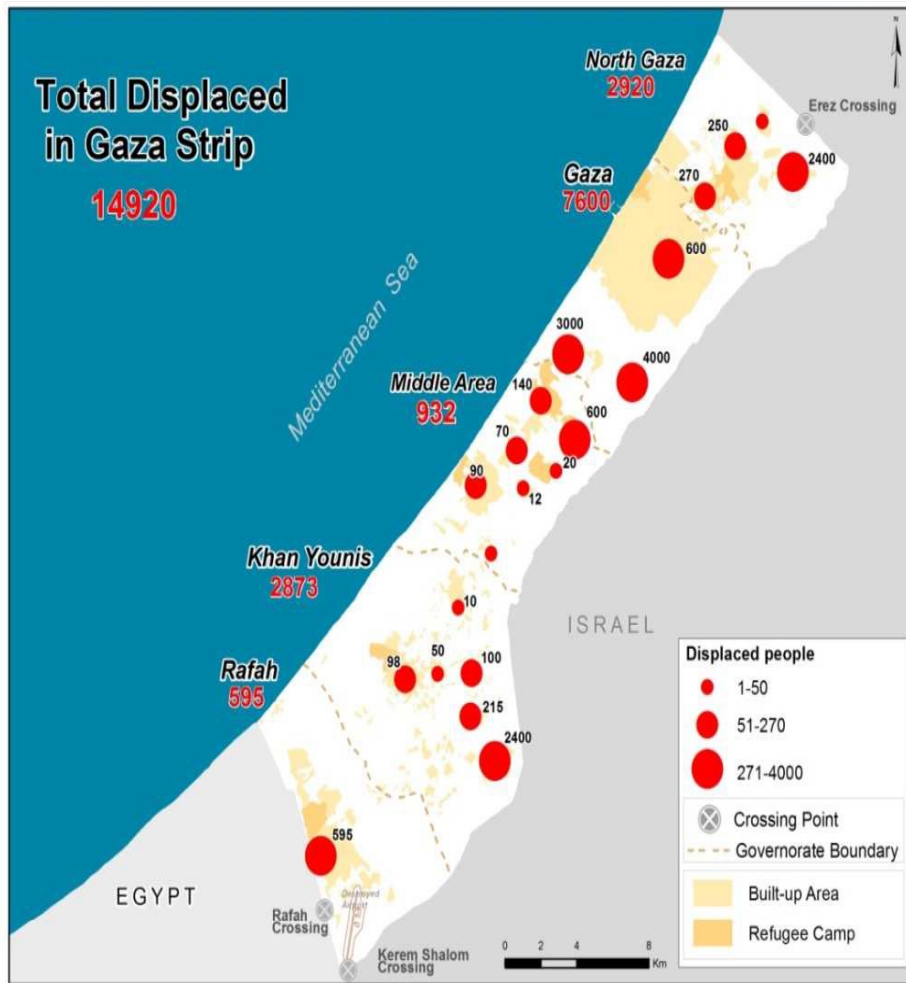


Figure 9: Relative distribution and numbers of IDPs, Gaza Strip (Source: OCHA)

### Explosive remnants of war ERW

Widespread ERW require a more rapid and prioritized response in most governorates of the Gaza Strip, however these huge quantities of ERW created considerable threat and fear among residents, and leave them vulnerable to risks of unexploded bombs [66].

### Psychosocial Impact

Psychosocial impact and stress caused by the intensity of the hostilities was reported, while children have suffered insomnia, hyperactivity, nocturnal enuresis (bedwetting), fear, anxiety to PTSD.

### Damage to Water and Sanitation Facilities

The evidence of damages or interruptions to WASH facilities, certain governorates in the strip have been rendered disproportionately vulnerable by limited access to water, the presence of solid waste close to shelters (20 m) and unprotected hazard areas close to water supplies [67].

### Health

In immediate response, the Ministry of Health MoH in Gaza formed a crisis management unit and opened an emergency command and control room at Shifa hospital which together with other hospitals, handled most of the casualty cases. However, the most pressing health issues was the access to drugs and medical disposables, as well as one of the main challenges to the health sector before and during the conflict was the availability of drugs and medical supplies; more than 40% of the essential drug items in the essential drug list and more than 50% of medical consumables were out of stock before and during the crisis.

The recent escalation exacerbated pre-existing drug and disposable shortages due to the high demand for pharmaceuticals and consumables to treat the large number of injured persons suffering various kinds of trauma, including fractures and burns, and the large number of surgeries [68].

MoH and UNRWA reported that 13 hospitals and PHC centers were partially damaged due to indirect shelling (9 MoH, 4 UNRWA). The Jordanian Field Hospital sustained serious damage after being directly hit, while two other hospitals the Gaza European and Beit Hanoun hospitals sustained minor damages [69]. The EMS reported that 3 ambulance drivers were injured during the war. In addition, 6 ambulances were damaged, 4 of these ambulances were damaged by shrapnel, and 2 ambulances were involved in accidents while transferring casualties. During the eight days, hospitals operated by the MoH in Gaza were functioning but struggling to cope with the large number of injuries with severely depleted medical supplies.

### Destroyed/Damaged Housing Units

Based on local government estimates the number of housing units which damaged or even destroyed across the strip was huge [70]. (See figure 10, 11)

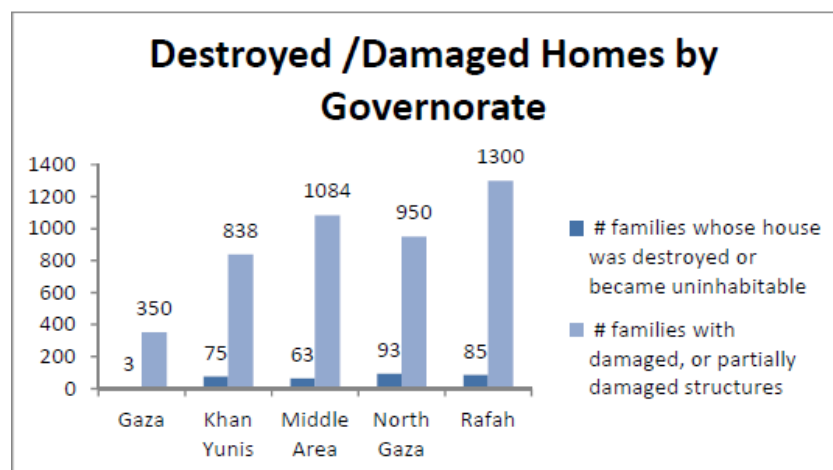


Figure 10: Damaged and Destroyed Homes totals by government (Source: OCHA)

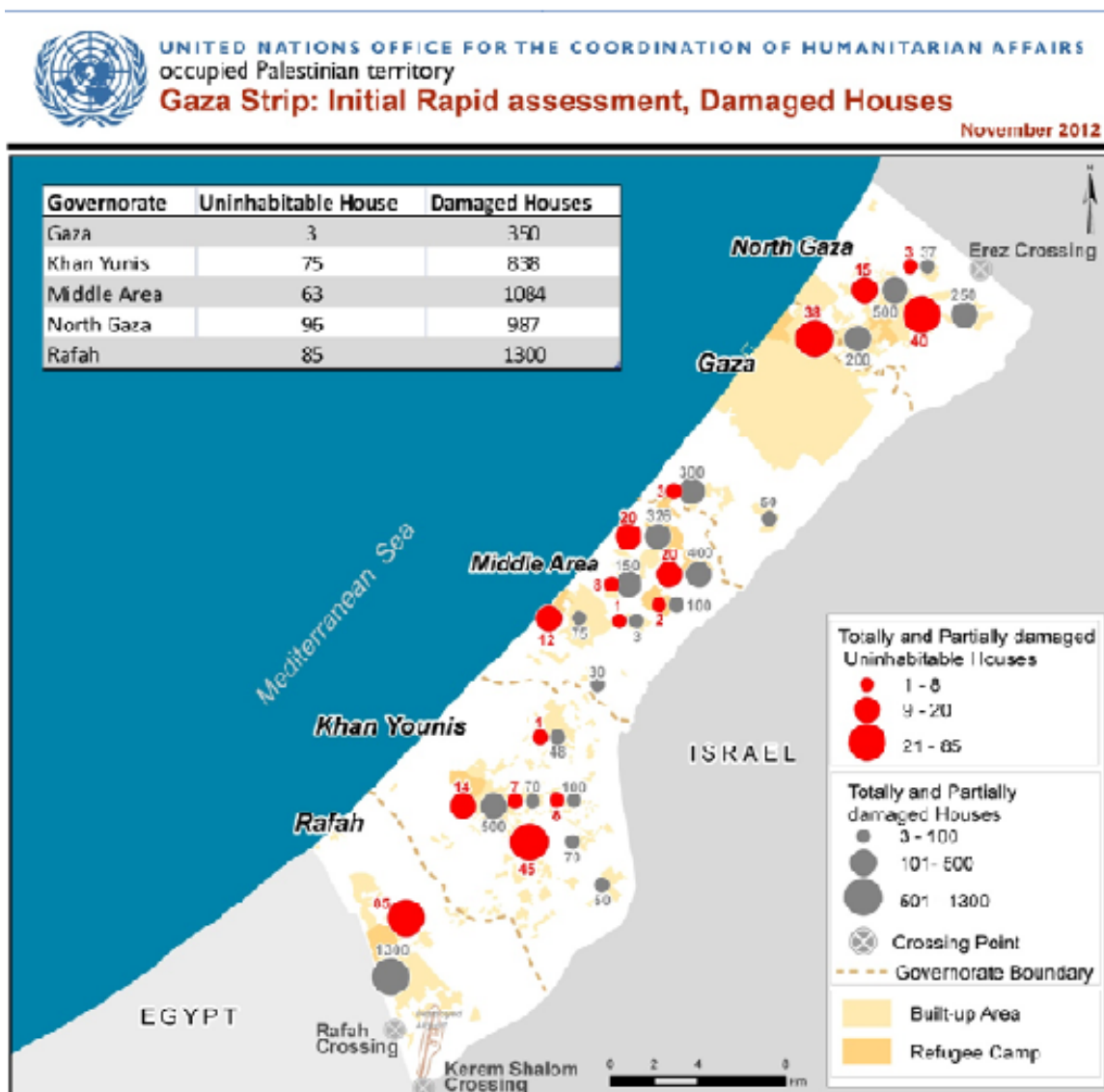


Figure11: Relative Distribution and Numbers of Damaged in destroyed homes (Source: OCHA)

### 5. Main disaster's risk factors in OPT

According to many different reports and studies addressing the main risk factors of disaster in Opt and the effects of these on the population, these reports and studies showed that opt is one of the hottest area for disasters in the world, particularly the humanitarian complex emergencies which going on for more than 6 decades without existing any possible humanitarian solutions due to the Israeli Occupation and their colonizing polices. Palestinian people they are high vulnerable to the complex emergencies and on-going conflict more than natural disasters, even though in some

areas in Palestine particularly West Bank there is high risk to natural disasters such as earthquake and seismic site effects .

Humanitarian complex emergencies is the first one of the main risk factors in OPT as well as other leading factors. Since the 1948 (Palestinian Nakba) the Palestinian people have been suffering from this endless conflict, which leave them high vulnerable to negative consequences of this conflict, according to different statistical reports of Palestinian Central Bureau of Statistics PCBS the high numbers of effected, killed and injured people going back to the reason of ongoing conflict between the Palestinians and Israelis, for instance.

The Number of Martyrs killed in the Al Aqsa Intifada between September 20<sup>th</sup> ,200 and December 31<sup>st</sup>,2012 was 7,766, of these 2,183 were form the West Bank, and 5,015were from Gaza Strip, and the bloodiest year was 2009 with 1,219 Palestinian martyrs, followed by 2002 with 1,192 martyrs, In addition, 306 martyrs were killed during 2012, 15 from the West Bank and 291 from Gaza Strip, of whom 189 were killed during Israeli Attacks on Gaza Strip in November 2012 [71] .

On the others side, Palestine is also considering a natural disasters prone area, since there is a high risk and probability to flash floods, droughts, desertification, earthquakes and its mostly local site effects such as landslides, liquefaction and amplification, according to different studies and researches conduct related to this kind of disasters.

West Bank is in high risk for natural disasters more than Gaza Strip especially the earthquakes and it's local side effects such as landslides, liquefaction and amplification , due to the geographical area of West Bank , as well as Gaza have been in a risk for these disasters and significantly environmental and water deteriorations. A study conducted in many areas in West Bank "An Assessment on Disaster Risk Reduction in the Opt " showed that several urban areas have high vulnerability to landslides and the probability of these occurrences will be increased if these areas are hit by strong earthquakes.

Lack of land use, planning code, random urban expansion and management practices these factors have increased the vulnerability of seismic site effects (landslides, liquefaction and amplification) [72]. Droughts, desertification and floods are the main natural hazards faced by the rural population in the region as well. In addition to that the vulnerability of flooding has increased due to the lack of land use planning and policy. Furthermore, the water flooding, landslides and desertification will reduce the use of land for agriculture, cause pollution of the underground water and reduce the amount of reliable drinking water as well. Moreover, vulnerabilities of properties, persons and institutions could be classified as highly vulnerable in Palestine, including social, economic, physical and environmental factors.

Based on the location and the seismicity of the region, an earthquake of magnitude more than 6 is expected to happen at any time in the near future, taking into consideration the 1927 earthquake, and will be epicentered in the north of the Dead



Sea, causing severe damage and loss due largely to the high vulnerability of common buildings. On the other hand, the predicted earthquake could be epicentered in the southern part of the Dead Sea according to other studies in the region [73].

Local site effect landslides, liquefaction, amplification and faulting systems play an important role in the intensity of earthquakes in Palestine. Thus, Earthquake-resistant designs of new structures and the evaluation of seismic vulnerability of existing buildings are taken into account in regards to site ground motions.

The topography and geology of the West Bank have been the main reasons behind several quite large landslides occurring over the past ten years [74]. Also, historical earthquakes indicate that historical Palestine suffered with several landslides, and due to its geology and location the Gaza Strip is expected to face liquefaction phenomena in several areas if a strong earthquake occurred in the region in the future.

Recent studies of large destructive earthquakes have shown that damages during the earthquakes are often caused by the amplification of seismic waves in near-surface geology, where the post disaster damage assessment showed that the local site effect may have a dominant contribution to the intensity of damage and destruction [75].

The effects of local geology on ground-motion amplification and building damage were studied recently in few areas in the West Bank [76] The results showed that the amplification factor varied between around 1 and 9 and even when the studied areas were small. To avoid the site effect: landslides, liquefaction, amplification and faulting systems in OPT, micro-zonation maps are needed.

Incidents of flash flooding have claimed the lives of hundreds of people over the years and affected the lives and livelihoods of thousands in the region. In the Jordan Valley in March 2003, where flooding of the Jordan River due to heavy rains caused extensive damage to farmland, resulting in the loss of an entire season's crops for many families living in the area.

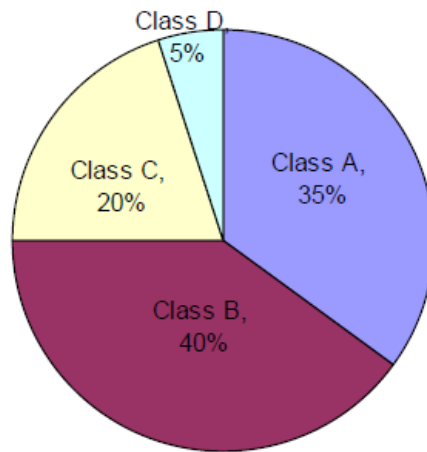
The probability of drought and desertification with their associated adverse consequences on economy and society are ever-present concerns in arid regions. Water has always been at the center of conflicts in the region, the recent experience with drought has renewed. Due to its geopolitical situation, geographical and geological position, Palestine could suffer in the future from the Hazard types shown in (table 12 ), also due to the limited resources and high vulnerability, it is expected that the effect of most of the above risks will be high, it will adversely affect the economy, society, environment, health and other sectors [77].

Like many countries, the opt faces the challenges of rapid urbanization, most of Palestinian cities in West Bank in particular are located in earthquake prone areas, this directly contributes to a rapid increase in the vulnerability in terms of the number of people and infrastructures exposed. A great variety of infrastructures exist in building materials, design and construction quality, structural and non-structural elements are

common. Seismic-proof construction is rarely observed and building codes in design and practices are not enforced.

Recent studies on the “vulnerability of buildings” for the main Palestinian cities (Jerusalem, Hebron, Ramallah, Nablus, Jenin, Tulkarem and Jericho) have been conducted by the Earth Sciences and Seismic Engineering Center ESSEC at An-Najah National University[78].

The results showed that around one third of the investigated buildings belong to the class A of seismic vulnerability “according to the European Macro-seismic scale 1998” many buildings will suffer heavy damage, whereas about 40 % of the buildings are in class B will suffer moderate damage, see figure 12.



Classes A, B, C according to EMS-1998

Figure 12: Seismic Vulnerability of Palestinian Common Building (Al- Dabbeek 2007a)

Based on these vulnerability indicators and expected earthquake intensities, total damage of 5-15% and partial damage of 20% are predicted in some areas of Palestinian cities. The high vulnerability to damages and losses in the buildings and infrastructures in opt are a direct result of the high percentage of weak buildings and infrastructures that do not comply with seismic resistant requirements.

This situation was created by the different major factors: bad construction practices and common fatal design mistakes of the buildings, Lack of a national code for seismic design construction, absence of national legislative laws and regulations for protection against earthquakes, as well as absence of effective mechanisms [79].

Table 15: Main Types of Hazards in OPT.

Hazard Type	Prob. Occurrence	Prob. Damage	Priority	Total Damage (Last 10 Years )	Last Event
Flash Flood	Low	Low -limited	Third	Million dollars	1963, 1966,1987, 1991,2009, 2012,2013
Earthquake	High	High	First	*	
Drought	Medium	High in long run	Second	Tens millions	-
Mud/landslide, rock falls,avalanches	Medium	Medium-High	Second	Millions	1992,1997, 2003, 2005, 2012 * *
Epidemic	Low	Low	Third	Millions	1981, 2010
Industrial accident	High	Medium-High	First	Millions	1999, 2006
Pop.displacement /refugee influx	High	High	First	Tens millions	2001,2006,
Sea disaster	Medium	High inlong run	Second	Tens Millions	-
Pollution Underground water	High	High	Second	Tens millions	-
Desertification	High	High inlong run	Second	Tens millions	-
Occupation, War	High	High	First	Billions	2000-2006, 2008 -2009, 12
Miscellinence	Low	Low	Third		2007

Pollution and environmental problems in opt are exacerbated by limited natural fresh water, overgrazing, deforestation, soil erosion and desertification, to fight environmental pollution Palestinian governmental and non-governmental organizations have developed special measures and awareness programs and have participated in many international activities and agreements related to climate change and environment protection. Major events triggered by seismic activity, namely climate change or climate variability may become trans-boundary [80].

A recent study conducted in Islamic University In Gaza Strip "Investigate the Disaster Management Process In the Gaza Strip " showed that the major factors affecting the disaster management process in Gaza were the insufficient financial resources at all stages of DRR , lack of local expertise in disaster management, the donor's ability to fund the reconstruction projects, the weak government institutions during the immediate post-disaster period, documentation system and archiving prior to towns and land holdings and Inadequate early warning system

The study recommended some possible solutions to overcome these faucets trough: identifying the vulnerable people and hazards areas within the districts; ensuring that all members of the community are aware of the potential effects of natural disasters; disseminating advice notes and good practice guides for disaster; maintaining contact with officials responsible for planning, construction, health and welfare, by issuing warnings, or providing fire and crowd control systems; low public awareness because disaster is seen as an act of God and communication system [81] .

Table 16: Disasters groups and sub-groups in OPT

<b>Disasters Groups</b>	<b>Disasters Sub-Groups</b>	<b>Hazard/Risk</b>
<b>Natural</b>	Geophysical	Earthquakes ,Mass Movement (Dry ), Avalanches, Landslides
	Metrological	Strom
	Climatologically	Extreme Temperature, Droughts
	Hydrological	Flash Flood, Mass Movement (wet)
	Biological	Epidemic Outbreaks
<b>Technological</b>	Industrial Accidents	Factories and others
	Miscellaneous accident	Others
	Transport Accidents	Road accidents
	Nuclear Risk	Dimona Reactor
<b>Man-made complex Emergencies</b>	Ongoing conflict, Violence, Emergencies, war and civil unrest	Ongoing conflict between the Palestinians and Israelis

## **6. Strategies of disaster prevention and response in OPT**

In terms of factors effecting on the disasters risk reduction in Opt, the Israeli occupation of Palestine, which is one of the leading factors for exacerbated the humanitarian situations and maximize the vulnerability of population, as well as the most important challenge because of its direct and indirect effects on the work of national organizations, as well as the lack of sufficient resources allocated to carry out activities of disaster risk reduction at all administrative levels. On the other hand, national policy for DRR exists but is not being implemented properly, and it is not integrated effectively in sectorial policies and national development plans.

The Palestinian Authority they are under the ongoing implementation of the Hyogo Framework for Action HFA since 2009, and they developing strategic plan for this implementation in the OPT, and till now they made some progress towards the implementation, however, the implementing of HFA take place in the West Bank cities, in Gaza strip is not in place or even in the agenda of Gaza Government basically because of geopolitical reasons with cites of West Bank. The following are the areas of actions and the strategic goals as well [82]:

**Area 1:** to ensure the more effective integration of DRR into sustainable development policies, planning and programming at all levels in OPT, with a special emphasis on mitigation, preparedness and vulnerability reduction, there are many strategic studies and plans have been prepared to mitigate the consequences of disasters in the field of health, agriculture, civil protection. Moreover, the Palestinian have been working with partners to integrate the disasters management polices into the development plans.

**Area 2:** to ensure the strengthening of institutions, mechanisms and capacities at all levels, in particular at the community level, that can systematically contribute to building resilience to hazards, the Palestinian Authorities they are obviously working to empower the leading role of the Higher Council of Civil Defense in Palestine, with establish a powerful equipped cadres to cope to disasters, as well as carrying out training courses in whole provinces in the area of first aid, rescue, ambulance and disaster medicine, through close cooperation and coordination between all institutions .

**Area 3:** to ensure the systematic incorporation of risk reduction approaches into the design and implementation of emergency preparedness, response and recovery programmes in the reconstruction of affected communities, the Palestinians they made somehow progress in developing inter-institutional joint strategic plan, mechanisms, strong programs in the field of disasters reduction, as well as integrating the DRR in the law and legislations with cooperation with Law of civil defense.

**The following are some achievements and progress in the priorities of HFA in OPT:**

1. To Ensure DRR is a national and a local priority with a strong institutional basis for implementation, some progress have been made in opt, but without systematic policy and institutional commitment due to the weakness in the resources under the occupation, as a result national policy and legal framework for DRR exists with decentralized responsibilities at all levels as a key indicator. To this aim, DRR was included in the National Development Plan 2010 and other plans such as; Security and Health sectors, Climate Change Policy and Strategy, Poverty Reduction Strategy, Common Country Assessments CCA, take into consideration, these plans in the place only in West Bank [83].

On the other hand, the framework for development assistance of the United Nations UNDAF devoted part of the aid for capacity development in the area of risk management, particularly training and rehabilitation for Civil Defense.

Besides, 2.26 % allocated from Palestinian national budget to DRR programs , as Well as 12 million USD allocated to hazard proofing sectorial development investments (e.g. transport, agriculture, infrastructure) [ 84 ].

2. Multi-hazard risk assessments based on hazard and vulnerability data were achieved with sustained commitment at all levels, in general there are several studies to assess the risks and threats in the place and sensitive buildings such as some hospitals and schools are built according to the recommendations of the seismic engineering in West Bank . As for the natural disasters all the information is documented such as the seismic record, landslides, epidemics and diseases, water scarcity, but there isn't a systematic and comprehensive analysis of data on disasters and climate change. Early warning systems are in place for all major hazards, with outreach to communities, however, risk prone communities not receive timely and understandable warnings of impending hazard events as well as there is no communication system and protocols in disasters, in other side, somehow of local people they have preparedness knowledge to cope with small scale disasters and the media have been involving in early warning dissemination [85].

3. Relevant information on disasters is available and accessible at some levels in opt to all stakeholders, through a national disaster information system which is accessible in West Bank more that Gaza Strip, some of these information system are: " The Government Media Office, Palestinian Central Bureau of Statistics PCBS and Palestinian Civil Defense .

Research methods and tools for multi-risk assessments and cost benefit analysis are developed and strengthened. In Palestine DRR included in the national scientific applied-research agenda, countrywide public awareness strategy exists to stimulate a culture of disaster resilience, with outreach to urban and rural communities, as well as there is public education campaigns and training of local government [86 ].

4. The integration of DRR as an integrated component in environment protection programs and natural resources management is in the place. Economic and productive sectorial policies and plans have been implemented to reduce the vulnerability of economic activities, in this filed there is some progress, but without systematic policy and/ or institutional commitment, there is investment to reduce the risk of vulnerable urban settlements through only investment in drainage infrastructure in flood prone areas and slope stabilization in landslide prone areas [87].

5. Technical and institutional mechanisms with a DRR perspective are in place to make schools and health facilities ready and safe in emergencies [88], the contingency plans, procedures and resources in place to deal with a major disasters.

There is a presidential decree to create a contingency fund to cope with disasters, but it is not activated and it does not have the financial reserves because we are a dependent country on foreign financial assistance.

## **7. General information about DRR organizations in OPT**

Despite the very difficult political, social and economic situation in our region, the opt is very well known for investment in human capital, many national agencies have demonstrated professional capabilities in various sectors of risk reduction, awareness, training relating to DRR. Moreover, the possibility of intentional NGOs providing more assistance and playing a more active role in preparedness and response in collaboration with the concerned governmental departments. The following organizations have good capabilities and experiences in opt.

### **Governmental Organizations and Ministries [98]**

#### **The Ministry of Interior and Higher Council of Civil Defense HCCD**

Represents the national body for disaster management, headed by the Minister of Interior and the Director General of Palestinian Civil Defense, they are playing a major role in disasters response and preparedness, however, there is two separated councils in West Bank and Gaza Strip , and they working individually as result of geopolitical situations .

#### **The Ministry of Planning**

The mission of the ministry is to support national different development initiatives and plans, including developing disasters preparedness and response plans in cooperation with the concerned national and international organizations.

#### **The Ministry of Health and related organizations**

In addition to their normal activities, MoH works in emergency conditions all the time, because of the political and security conditions in opt, despite the limited resources

they have, MoH works within the capabilities available without a clearly defined plan to deal with disasters and they working together with other national and international organizations in case of emergency complex, natural disasters and epidemic outbreaks.

### **The Ministry of Public Works and Housing and Ministry of Local Government**

Dedicate all available resources for the rescue operations and all related actions, in addition to their normal activities related to issuing building licenses; maintaining infrastructures and many other sectors of the people's life, as well as they have leading role in recovery and reconstruction after the disasters.

### **The Ministry of Transport**

Collect a database of the owners of heavy duty equipment and other tools (bulldozers, excavators, trucks, loaders, cranes etc.), as well as monitoring and forecasting the weather conditions through the meteorological department.

### **The Youth Sector (Ministry of Education, Ministry of Youth and sports)**

All human resources, assets and capabilities devoted to support in the relief, rescue, and evacuation in times of disasters and emergencies.

### **The Ministry of Agriculture**

Working to mitigate the effect of possible natural disasters and complex emergencies on the agricultural land and ensure food security.

Other NGOs, related to risk reduction: The Ministry of Telecommunications and Information Technology, the Media, the Water Authority and Environmental Quality Authority.

### **Non-Governmental Organizations**

#### **The Palestinian Red Crescent Society PRCS**

The Palestinian Red Crescent Society has paid special attention to the issue of disasters since it was established in 1968, PRCS is considered one of the most important organizations in this area, Its activities cover all of the Palestinian territory West Bank, Gaza Strip and Jerusalem, It has played a very effective and major role during the second Intifada and Complex emergencies during Gaza wars, PRCS has 22 branches covering all governorates and with more than 2000 very well equipped volunteers working under the Unit of Disasters [90 ].

#### **The Earth Sciences and Seismic Engineering Center ESSEC**

The Earth Sciences and Seismic Engineering Center at An-Najah National University is the only specialist center in the opt in the fields of natural risk assessment, disaster



management and earthquake engineering. Since its establishment in September 1996, ESSEC oriented its activities; awareness, training, teaching studies and research to cover all sectors of people like citizens, professionals and decision makers in West Bank only [91].

### **The National Agency for Disaster Risk Mitigation NADRM**

The National Agency for Disaster Risk Mitigation was founded July 31<sup>st</sup> 2006, It has been responsible for the formation of a national framework that gathers all of the NGOs working in the field of disaster management and emergency support, in addition to planning and conducting capacity building and quality assurance programs for the concerned organizations. Most importantly, this national agency is only working in the West Bank cities without integrated Gaza Strip in their activities, However, Gaza Government with support from international and national agencies they working collectively to develop a national agency [92].

Other NGOs: The Palestinian Engineer's Association, The Palestinian Contractor's Union, Union of Health Care Committees UHCC, Research Centre land, Union Committees of Agriculture Relief, Hydrological Group, and the Applied Research Institute – Jerusalem. In Gaza Strip the Palestinian Agricultural Relief Committees PARC [93], Union of Health Work committees UHWC, Environmental Friends Association as well.

Concerning the universities, in the West Bank, An-Najah University has the Water Environmental Studies Institute, while Bir Zeit University has a center for water studies as well. In Gaza the Islamic University has the center of Environment Studies, while Al-Azhar University has the center for Water Studies.

In addition to the above mentioned organizations, there are other INGOs supporting the resilient of Palestinian civil societies to disasters and complex emergencies through funding different programs of mitigation and preparations through several scope of works. As examples; UNDP/ PAAP, Catholic Relief Services CRS, Christian Aid, International Committee of Red Cross ICRC, IFRC in collaboration with the PRCS, Food and Agricultural Organization FAO, World Health Organization WHO, Doctors without Borders MSF, Oxfam International WASH and Safe the Children.

## **8. Challenges and gaps**

1. One of the main challenges is the Israeli Occupation and its colonize policies, which effect directly on the development of the DRR programs at all levels, as well as the Gaza Siege imposed by the Israeli since 2006, which leave people high vulnerable to ongoing complex humanitarian emergency situations.
2. Lacking awareness of the natural hazard, human vulnerability and social risks particularly in Gaza Strip.

3. Weak of capacity and training in disaster risk management and policy implementation at different government level in opt.
4. Legal frameworks for DRR are very limited, with more focusing on the response activities, where prevention or mitigation is missing.
5. Lack of appropriate support for the civil defense in terms of resources, training and other needs, which resulted in lack of specialized and well trained human recourses in rescue operations particularly in Gaza , as well as the absence of well-equipped operations central rooms on the national levels covering whole different governorates.
6. The location of the opt between Israel and Jordan, in addition to its very small area, make it very vulnerable to different types of disasters especially earthquakes, and the emergency support from these countries will be very limited since they will also be affected by the disaster.
7. Lack of adequate coordination among different governmental and non-governmental organizations and the private sector as well.
8. Absence of a clear and comprehensive national plan for DRR and risk management.
9. Absence of land use policy planning, codes and regulations which emphasize the safety requirements in the buildings in Gaza Strip and somehow in West Bank.

## 9. Recommendations

The overall recommendations provided in this profile have been deduced based on the available data on disasters, risks, capacity and vulnerability assessments in opt [94].

***To ensure quick and adequate national emergency response to disaster, the following preparedness activities should be taken into to consideration;***

- 1- Improve the Civil Defense capacity to cope with different disasters, and create coordination system for operational emergency response with other key players and clusters.
- 2- Work on accomplishing stand-by plans for each institution in order to enable them to deal with emergency situations.
- 3- Conducting emergency response capacity building and regular simulations for all levels.
- 4- Developing public awareness programmes for the safety measures within the local community.
- 5- Developing disease surveillance systems for natural disasters and emergencies.

***To reduce vulnerabilities in natural disasters, the disasters preparedness and response activities should be enhanced through;***

1- Holding national workshops and training courses to discuss critical issues in terms of natural disasters such as earthquakes and floods.

2- Develop legislations to control the land use policy in a way that maintains the sustainable development, environment stability, to reduce the risks of earthquakes, landslides and other natural disasters through risk and hazard mapping prone areas.

3- Include courses of risk assessment, seismic vulnerability , seismic design of buildings, safety and disaster management as courses part of engineering faculties in the opt, and other faculties, most importantly courses in emergency health responses and contingency plans .

4- Establishing clear mechanisms for monitoring and evaluating disaster preparedness and response activities.

5- Developing the warning system and using technological methods to mitigate the effects of disasters through enforcing scientific researches and information disseminations.

***To improve the resilience of Palestinian communities to disasters and emergencies, the following activities should be taking in to consideration;***

1-Encourage all governmental and non-governmental institutions to adopt the Hugo Framework for Actions 2005 – 2015 and encourage the international organizations to consider this in their future development projects .

2- Establish national platform for DRR at all levels, as well as developing up to date a national disasters database, including complex emergency database for each governorate or city.

3- Develop special programmes to enhance the capacities of those working in the media on how to perform before, during and after natural disasters and emergencies in general.

4- Consider efficient and logical distribution of hospitals, health centers and all centers related to response, to cover as much as possible of areas.

Furthermore to the above mentioned required measures, the health sectors and the rescue operations should be given priority, this includes: developing a national mental health plan to manage the psychosocial aspects of disaster. On the other side, strengthen the joint coordinating among whole related bodies in opt to implement the Ten-point Checklist for making Palestinian cities resilient.

## **10. Discussion and conclusions**

Palestine is a natural disasters prone area particularly earthquakes, floods, landslides, droughts, desertification and liquifcation, these disasters leave the Palestinians high vulnerable to be affected. On the other side, Palestine is a mostly complex emergencies prone area since 1948, and according to many national and international statistical reports the majority of causalities, personal and properties loss as well as damages coming back to the on-going conflict between the Palestinian and Israelis.

As a result of the unique Palestinian case, no geographic connection between the Gaza Strip and West Bank, the complications caused by the occupation , nonexistence of national armed forces, weaknesses of national programs and public policies on preparedness, mitigation, and emergency response, as well as the weak institutional capacity in disaster management and rescue operations, these factors effect negatively on the implementation of the Hyogo Framework for Action in the whole region , nevertheless there is minor achievement in the some cities remarkably in the West Bank related to disasters preparedness and response .

In the Occupied Palestinian Territory, few national bodies are key players in disaster risk management and response , but all of them are facing considerable capacity gaps and challenges, which were identified in this profile and recommendations were provided to address these gaps .National policies and legislations are focusing towards rescue and relief activities in different regions of the country in time of disasters ,so there is a need to shift this to disaster preparedness and prevention and incorporating disaster management into the development plans of the country, considering the disaster as national priority towards the implementation of “Hyogo Framework for Action”.

Since communication to the public is critical in reducing the impact of disasters on the community, there is a need to develop risk communications programs as an integral part of all plans in all levels especially in Gaza Strip, these proposed risk communications programs could incorporate risk awareness, community education about risks and precautionary measures, warning systems for critical situations. In addition, the use of media for disseminating awareness programmes should be broadened and encouraged so that the message will reach a larger audience.

Initiatives on national cooperation are very limited, however, the humanitarian organizations in opt can play a crucial role in developing bilateral and multi-lateral links with West Bank and Gaza Strip in DRR, and generate useful information in this filed.

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